

THAT WHICH IS CLAIMED IS:

1. A method of distributing workload between data processing systems executing an application which  
5 communicates over a network, the method comprising:

receiving a request for a connection to the application over the network;

obtaining workload information for the data processing systems;

10 obtaining network quality of service information associated with communications over the network for respective ones of the data processing systems;

15 generating workload metrics associated with respective ones of the data processing systems utilizing the workload information and the corresponding network quality of service information for the data processing systems; and

20 distributing the requested connection to instances of the application executing on the data processing systems based on the generated workload metrics.

2. A method according to Claim 1, wherein the network quality of service information comprises at least one of network packet loss information, network timeout information, and number of connections information.

3. A method according to Claim 1, wherein the workload information comprises a weight value (W) corresponding to a data processing systems processing capacity.

4. A method according to Claim 3, wherein the network quality of service information comprises a loss weight (F-loss) based on packet loss ratio, a network timeout weight (F-timeout) based on a network timeout ratio and a connection weight (F-con) based on a number 5 of active connections.

5. A method according to Claim 4, wherein F-loss is a ratio of retransmitted packets to total transmitted 10 packets, wherein F-timeout is a ratio of number of timeouts to number of transmitted segments, and wherein F-con is a ratio of current connections to total allowed connections.

15 6. A method according to Claim 4, further comprising the steps of:

determining a value for F-loss by mapping a TCP loss ratio to the value for F-loss;

20 determining a value for F-timeout by mapping a timeout loss ratio to the value for F-timeout; and

25 determining a value for F-conn by determining if a number of current connections exceed a predefined percentage of a total number of allowed connections and setting F-con to 1 if the total number of connections exceeds the predefined percentage of the total number of allowed connections and to 0 if the total number of connections does not exceed the predefined percentage of the total number of allowed connections.

7. A method according to Claim 4, wherein the step of generating workload metrics comprises the step of evaluating the equation:

$$Aw = (1 - \text{MIN}(1, F\text{-loss} + F\text{-timeout} + F\text{-con})) * W$$

5 where Aw is the workload metric.

8. A method according to Claim 1, wherein the quality of service information comprises quality of service information for an instance of the application 10 executing on one of the data processing systems.

9. A method according to Claim 1, wherein the quality of service information is divided into classes of quality of service information associated with the 15 application based on a common constraint, the method further comprising the step of:

determining a class of quality of service information associated with the connection request; and

wherein the step of obtaining network quality of 20 service information associated with communications over the network for the data processing systems comprises obtaining network quality of service information for the class of quality of service information associated with the connection request.

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10. A method according to Claim 9, wherein the step of generating workload metrics comprises the step of combining the workload information and the corresponding network quality of service information for the data 30 processing systems based on the class of quality of service information associated with the request so as to

provide workload metrics based on the workload information, the quality of service information and the class of quality of service information associated with the request.

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11. A method according to Claim 1, wherein the data processing systems comprise data processing systems in a Sysplex, wherein the steps of receiving a request for a connection to the application over the network, obtaining workload information for the data processing systems, 10 obtaining network quality of service information associated with communications over the network for the data processing systems, generating workload metrics and distributing the requested connection to application instances on the data processing systems based on the workload metric are carried out by a routing communication protocol stack in the Sysplex.

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a router operably associated with the workload distributor which receives requests for connection to an application executing on ones of the data processing systems and distributes the connections to data processing systems in the cluster of data processing systems selected by the workload distributor.

14. A system according to Claim 13, wherein the router comprises a routing communication protocol stack.

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15. A system according to Claim 14, wherein the requests for connections to the application comprise requests for connections to a dynamically routable virtual Internet Protocol address.

15

16. A system according to Claim 13, further comprising policy agents associated with the data processing systems which provide quality of service information to the workload distributor.

20

17. A system according to Claim 13, wherein the network quality of service information comprises a loss weight (F-loss) based on packet loss ratio, a network timeout weight (F-timeout) based on a network timeout ratio and a connection weight (F-con) based on a number of active connections.

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18. A system according to Claim 17, wherein the workload distributor is configured to evaluate the equation:

$$Aw = (1 - \text{MIN}(1, F\text{-loss} + F\text{-timeout} + F\text{-con})) * W$$

where  $A_w$  is a workload metric and  $W$  is the workload information and wherein the workload distributor selects a data processing system with a best  $A_w$  value.

5           19. A system according to Claim 17, wherein F-loss  
is determined by mapping a TCP loss ratio to the value  
for F-loss, F-timeout is determined by mapping a timeout  
loss ratio to the value for F-timeout and F-conn has a  
value of 1 if a total number of connections to the  
10 application associated with the connection request  
exceeds a predefined percentage of the total number of  
allowed connections and to 0 if the total number of  
connections does not exceed the predefined percentage of  
the total number of allowed connections.

15           20. A system according to Claim 18, wherein the  
workload distributor is configured to evaluate the  
equation:

20           
$$A_w = (1 - \text{MIN}(1, F\text{-loss} + F\text{-timeout} + F\text{-con})) * W$$
  
where  $A_w$  is a workload metric and  $W$  is the workload  
information and wherein the workload distributor selects  
a data processing system with a best  $A_w$  value.

25           21. A system for distributing workload between data  
processing systems executing an application which  
communicates over a network, comprising:

means for receiving a request for a connection to  
the application over the network;  
means for obtaining workload information for the  
30           data processing systems;

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means for obtaining network quality of service information associated with communications over the network for respective ones of the data processing systems;

5       means for generating workload metrics associated with respective ones of the data processing systems utilizing the workload information and the corresponding network quality of service information for the data processing systems; and

10      means for distributing the requested connection to instances of the application executing on the data processing systems based on the generated workload metrics.

15      22. A system according to Claim 21, wherein the network quality of service information comprises at least one of network packet loss information, network timeout information, and number of connections information.

20      23. A system according to Claim 21, wherein the workload information comprises a weight value (W) corresponding to a data processing systems processing capacity.

25      24. A system according to Claim 23, wherein the network quality of service information comprises a loss weight (F-loss) based on packet loss ratio, a network timeout weight (F-timeout) based on a network timeout ratio and a connection weight (F-con) based on a number 30     of active connections.

25. A system according to Claim 24, wherein F-loss  
is a ratio of retransmitted packets to total transmitted  
packets, wherein F-timeout is a ratio of number of  
timeouts to number of transmitted segments, and wherein  
5 F-con is a ratio of current connections to total allowed  
connections.

26. A system according to Claim 24, further  
comprising:

10 means for determining a value for F-loss by mapping  
a TCP loss ratio to the value for F-loss;

means for determining a value for F-timeout by  
mapping a timeout loss ratio to the value for F-timeout;  
and

15 means for determining a value for F-con by  
determining if a number of current connections exceed a  
predefined percentage of a total number of allowed  
connections and setting F-con to 1 if the total number of  
connections exceeds the predefined percentage of the  
20 total number of allowed connections and to 0 if the total  
number of connections does not exceed the predefined  
percentage of the total number of allowed connections.

27. A system according to Claim 24, wherein the  
25 means for generating workload metrics comprises means for  
evaluating the equation:

$$Aw = (1 - \text{MIN}(1, F\text{-loss} + F\text{-timeout} + F\text{-con})) * W$$
  
where Aw is the workload metric.

30 28. A system according to Claim 21, wherein the  
quality of service information comprises quality of

service information for an instance of the application executing on one of the data processing systems.

29. A system according to Claim 21, wherein the  
5 quality of service information is divided into classes of  
quality of service information associated with the  
application based on a common constraint, further  
comprising:

means for determining a class of quality of service  
10 information associated with the connection request; and

wherein the means for obtaining network quality of  
service information associated with communications over  
the network for the data processing systems comprises  
means for obtaining network quality of service  
15 information for the class of quality of service  
information associated with the connection request.

30. A system according to Claim 29, wherein the  
means for generating workload metrics comprises means for  
20 combining the workload information and the corresponding  
network quality of service information for the data  
processing systems based on the class of quality of  
service information associated with the request so as to  
provide workload metrics based on the workload  
25 information, the quality of service information and the  
class of quality of service information associated with  
the request.

31. A computer program product for distributing  
workload between data processing systems executing an

application which communicates over a network,  
comprising:

a computer readable storage medium having computer  
readable program code embodied therein, the computer  
5 readable program code comprising:

computer readable program code which receives a  
request for a connection to the application over the  
network;

10 computer readable program code which obtains  
workload information for the data processing systems;

computer readable program code which obtains network  
quality of service information associated with  
communications over the network for respective ones of  
the data processing systems;

15 computer readable program code which generates  
workload metrics associated with respective ones of the  
data processing systems utilizing the workload  
information and the corresponding network quality of  
service information for the data processing systems; and

20 computer readable program code which distributes the  
requested connection to instances of the application  
executing on the data processing systems based on the  
generated workload metrics.

25 32. A computer program product according to Claim  
31, wherein the network quality of service information  
comprises at least one of network packet loss  
information, network timeout information, and number of  
connections information.

30

33. A computer program product according to Claim 31, wherein the workload information comprises a weight value (W) corresponding to a data processing systems processing capacity.

5

34. A computer program product according to Claim 33, wherein the network quality of service information comprises a loss weight (F-loss) based on packet loss ratio, a network timeout weight (F-timeout) based on a network timeout ratio and a connection weight (F-con) based on a number of active connections.

35. A computer program product according to Claim 34, wherein F-loss is a ratio of retransmitted packets to total transmitted packets, wherein F-timeout is a ratio of number of timeouts to number of transmitted segments, and wherein F-con is a ratio of current connections to total allowed connections.

36. A computer program product according to Claim 34, further comprising:

computer readable program code which determines a value for F-loss by mapping a TCP loss ratio to the value for F-loss;

computer readable program code which determines a value for F-timeout by mapping a timeout loss ratio to the value for F-timeout; and

computer readable program code which determines a value for F-con by determining if a number of current connections exceed a predefined percentage of a total number of allowed connections and setting F-con to 1 if

the total number of connections exceeds the predefined percentage of the total number of allowed connections and to 0 if the total number of connections does not exceed the predefined percentage of the total number of allowed connections.

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37. A computer program product according to Claim 34, wherein the computer readable program code which generates workload metrics comprises computer readable program code which evaluates the equation:

10 
$$Aw = (1 - \text{MIN}(1, F\text{-loss} + F\text{-timeout} + F\text{-con})) * W$$
 where Aw is the workload metric.

38. A computer program product according to Claim 31, wherein the quality of service information comprises quality of service information for an instance of the application executing on one of the data processing systems.

20 39. A computer program product according to Claim 31, wherein the quality of service information is divided into classes of quality of service information associated with the application based on a common constraint, further comprising:

25 computer readable program code which determines a class of quality of service information associated with the connection request; and

wherein the computer readable program code which obtains network quality of service information associated 30 with communications over the network for the data processing systems comprises computer readable program

code which obtains network quality of service information for the class of quality of service information associated with the connection request.

5           40. A computer program product according to Claim  
39, wherein the computer readable program code which  
generates workload metrics comprises computer readable  
program code which combines the workload information and  
the corresponding network quality of service information  
10          for the data processing systems based on the class of  
quality of service information associated with the  
request so as to provide workload metrics based on the  
workload information, the quality of service information  
and the class of quality of service information  
15          associated with the request.

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